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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/994,508	11/27/2001	Jae-Hak Kim	SAM-0298	1079

7590 09/15/2004

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EXAMINER	
RAO, SHRINIVAS H	
ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 09/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/994,508	KIM ET AL.	
	Examiner	Art Unit	
	Steven H. Rao	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 June 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☐ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 November 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Priority

Receipt is acknowledged of paper submitted under 35 U.S.C. 114 requesting a RCE , Of U.S. serial No. 09/994508 filed on June 04, 2003 , which (Us 09/994508 itself claims priority from Korean Patent Application Nos.2000-74836filed on December 08, 2000 and Korean Patent Application No. 2001-36933 filed on June 27, 2001. which papers have been placed of record in the file.

Request for Continued Prosecution Examination (RCE)

The request filed on 05/29/2003 for a Request for Continued Prosecution Application (RCE) under 37 CFR 1.114 (d) based on parent Application No. 09/994508 is acceptable and a RCE has been established.

Therefore claims 1 and 11 as recited in the amendment accompanying the RCE request and claims 2-10 and 12-22 as previously recited are currently pending in the Application. An action on the RCE follows.

Information Disclosure Statement

No IDS has been filed to date in the Application.

Preliminary Amendment Status

Acknowledgment is made of entry of preliminary amendment filed 5 /29 / .2003.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1to 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forbes et al. (U.S. Patent No. 5,926, 740, herein after Forbes) . and Loboda et al. U.S. Patent No. 5,818,071, herein after Loboda).

With respect to claim1, Forbes describes a method of making a semiconductor device having a low dielectric interlayer insulation layer, including the steps of completely forming a silicon oxy carbide layer on a substrate (fig. 1 # 105 and 110, col. 8 line 19 to 20). treating completely formed the oxy carbide layer with plasma (col. 9 lines 13, it is inherent that when Forbes forms a graded composition layer, Fobres disclosure includes forming a first stiochiometeric layer of SiOC layer completely and continue treating the so completely formed layer wit the plasma to formed the second SiOC layer on top of the first layer) and stacking photo resist on the plasma treated oxy carbide layer and patterning the resultant structure (Forbes fig. 1 # 115, col. Col. 7 line 18).

Forbes does not specifically mention the SiOC layer as being a low diielectric constant layer.

However, Loboda , a patent from the same filed of endeavor, describes in col. 3 lines 25 to 30 several materials including SiOC as low dielectric constant materials to be used between metal wire interconnects to form layers of low dielectric constant with a DK less than about 3.5 which provides more stable devices.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to Loboda's use of the SiOC layer also as a low dielectric constant layer in Forbes method steps wherein the SiOC layer is used without mentioning its additional low constant dielectric properties to form layers of low dielectric constant with a DK less than about 3.5 between metal wire interconnects which provides more stable devices. (Loboda col. 3 lines 20 to 25).

With respect to claims 2 to 3, wherein the silicon oxy carbide layer is formed by CVD method by supplying a gas containing nitrogen atoms and a gas selected from Helium, hydrogen, N20, Oxygen and Argon (Forbes col. 10 line 15 -CVD, line 18 to 20 gas containing nitrogen atoms).

With respect to claim 4, wherein the plasma treatment is performed in situ in a PECVD chamber (col. 10 line 16).

With respect to claims 5 and 6, wherein the plasma treatment is performed at a pressure of 1 to 10 Torr and temperature of 300 to 400 degrees centigrade.(Loboda col. 2 lines 63 to 64, 500 to 600 degrees C and col. 3 line 5 pressure).

With respect to claim 7, wherein the silicon oxy carbide is made from a gas of the methyl silane group as a source gas for carbon and silicon and using at least one of , N20, Oxygen for another source gas of oxygen wherein the methyl silane group that one or more hydrogen group of silane is substituted as a methyl group (Loboda col. 3 lines 10to 15).

With respect to claims 9 and 10 , wherein the patterning comprises , exposing the photo resist to light below a photo mask (col. 1 lines 30 to 35), performing a post exposure bake and developing the photo resist (Forbes col. 1 line 47, Loboda col. 3 lines 58).

With respect to claim 11, Forbes describes a method of making a semiconductor device having a low dielectric interlayer insulation layer, including the steps of stacking a completely formed silicon oxy nitride layer (SiOC) as the low dielectric interlayer insulation layer on a substrate, (Forbes fig. 1 # 115, col. Col. 7 line 18) treating the completely formed silicon oxy carbide layer with plasma (col. 9 lines 13, it is inherent that when Forbes forms a graded composition layer, Fobres disclosure includes forming a first stiochiometeric layer of SiOC layer completely and continue treating the so completely formed layer wit the plasma to formed the second SiOC layer on top of the first layer) and forming an inter connection at the silicon oxy carbide layer using a damascene process. (Forbes figure 1, col. 5 line 11, Loboda fig. 1 and col.3 lines 59t o col. 4 lines 14).

Forbes does not specifically mention the SiOC layer as being a low dielectric constant layer.

However, Loboda , a patent from the same filed of endeavor, describes in col. 3 lines 25t o 30 several materials including SiOC as low dielectric constant materials to be used between metal wire interconnects to form layers of low dielectric constant with a DK less than about 3.5 which provides more stable devices.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to ijnclude Loboda's use of the SiOC layer also as a low dielectric constant layer in Forbes method steps wherein the SiOC layer is used without mentioning its additional low constant dielectric properties to form layers of low dielectric constant with a DK less than about 3.5 between metal wire interconnects which provides more stable devices. (Loboda col. 3 lines 20□25).

With respect to claim 12, wherein H2 plasma is used for treating with plasma Loboda col. 2 line 40□45 and forming an insulation capping layer on the silicon oxy carbide layer after treating with plasma and before forming an interconnection (Loboda col. 3 lines 59□col. 4 lines 5) .

With respect to claim 13, wherein the PECVD laser is formed by supplying at least one of a silane gas and a TEOS (Forbes col. 9 lines 1□10).

With respect to claim 14, wherein the H2 plasma is performed under the H2 ambient at a temperature of 250 to 400 degrees and 1to10 Torr under an RF field. (Loboda col. 2 lines 63 to 64, 500 to 600 degrees C and col. 3 line 5 pressure, col. 10 line 19-RF).

With respect to claim 15, wherein forming a photo resist pattern over the SiOC (Forbes fig. 1 # 115, col. Col. 7 line 18) forming a groove at the top of the silicon oxy

carbide layer using the photo resist pattern as an etch mask (Loboda fig. 1 groove on top of layer 5, col. 3 lines 59 col. 4 lines 14)removing the photo resist by ashing method using oxygen plasma at the groove formed structure (Forbes col. 1 line 47 to 49), sequentially stacking a barrier metal and a metal layer for interconnection at the groove formed substrate to fill the groove (Loboda fig. 1 groove on top of layer 5, col. 3 lines 59 to col. 4 lines 14) removing the metal layer for inter connection stacked at the top surface of the silicon oxy carbide using a CMP process (CMP well known in the art).

With respect to claim 16, wherein the metal layer interconnection is cooper. (Lobado col. 2 line 20).

With respect to claim 17, wherein the damascene process comprises forming the groove and the n forming a contact hole in the region of the groove (Loboda fig.1 groove on top of layer 5, col. 3 lines 59 col. 4 lines 14).

With respect to claim 18, wherein the Silicon oxy carbide layer is formed by spin on glass technique (Loboda col. 3 lines 57□58).

With respect to claims 19 and 20 wherein an organic polymer layer is formed at the silicon oxy carbide layer by a coating method after plasma treatment (fig. 1 layer 9, col. 3 lines 27□organic material coating method □col.3 line 37), SOG (col.3 line 29) PECVD(col. 31ine 34).

With respect to claim 21 , wherein curing is performed at 400 to 450 degrees C (Loboda col. 2 lines 63 to 64, 500 to 600 degrees C).

With respect to claim 22, wherein the damascene process is performed by a dual damascene method comprising of forming a groove at the organic polymer layer using a

patterning process and forming a contact hole at the silicon oxy carbide layer at a region of the groove through a patterning process (Loboda fig. 1 and col.3 lines 59 to col. 4 lines 14).

Response to Arguments

Applicant's arguments filed 5/29/200 have been fully considered but they are not persuasive. for the following reasons :

Applicants' first contention that Forbes reference only teaches forming the silicon oxy carbide layer using plasma and there is no subsequent plasma treatment step therefore Forbes fails to teach or suggest the invention claimed is not persuasive because when Forbes forms a graded composition layer, Fobres disclosure includes forming a first stiochiometeric layer of SiOC layer completely and continue treating the so completely formed first stiochiometeric SiOC layer with the plasma to form the second stiochiometeric SiOC layer on top of the first layer and continue the process till the substantially continuously graded composition SIOC layer is formed.

Applicants' second contention that Laboda does not teach forming silicon oxynitride layer on a substrate and treating the formed silicon oxycarbide layer with plasma is nor relevant because these two steps have been taught by the applied primary Fobres reference and need not also be taught by the secondary Laboda reference.

Applicants' arguments with regard to their previous piece meal analysis is not persuasive because Applicants' have again above engaged in the similar piece meal analysis.

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Steven H. Rao whose telephone number is (571) 272-1718. The examiner can normally be reached on Monday□ Friday from approximately 7:00 a.m. to 5:30 p.m.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308□0956. The Group facsimile number is (703) 308□7722.

Steven H Rao
Patent Examiner
September 09, 2004.

Group facsimile number is (703) 308□7722.

Steven H Rao

Patent Examiner

September 09, 2004.

LONG PHAM
PRIMARY EXAMINER